

CLAIMS

What is claimed is:

1. A single-sided driver used with a display panel, the single-sided driver comprising:
a single-sided driver circuit having predetermined circuit elements including energy accumulation elements and switching elements, and establishes current flow paths to generate predetermined driving voltage waveforms required for both X and Y axes electrodes according to predetermined switching sequences to drive the display panel.
2. The driver of claim 1, wherein the single-sided driver circuit repeatedly supplies zero voltage and +/- multi-level voltages that are symmetric with respect to the zero voltage across the X and Y axes electrodes of the display panel during a sustain discharge period.
3. The driver of claim 1, wherein a source voltage to be supplied to the single-sided driver circuit is set to be twice as much as a voltage that is supplied to the display panel during a gas discharge mode in the sustain discharge period.
4. The driver of claim 1, wherein the single-sided driver circuit comprises:
an isolation and reset circuit combination which isolates an energy recovery path and establishes a current flow path to generate reset voltage waveforms that are supplied to both the X and Y axes electrodes to eliminate wall charges in the display panel during a reset period;
a scan pulse generation circuit which establishes a current flow path to generate address discharging voltage waveforms to be supplied to the X and Y axes electrodes to generate wall charges in the display panel during an address period;
a sustain driver circuit which establishes charging/discharging paths to charge/discharge the display panel according to the predetermined switching sequences to drive the display panel during a sustain discharge period, and establishes a current flow path to generate the reset voltage waveform and the address discharging voltage waveforms during the reset period and the address period, respectively, in combination with the isolation and reset circuit and the scan pulse generation circuit.
5. The driver of claim 4, wherein the sustain driver circuit comprises a capacitor with greater capacitance than the display panel on the charging/discharging path.

6. The driver of claim 5, wherein the capacitor is set to be charged with a voltage supplied to the display panel during a gas discharge mode in the sustain discharge period.

7. The driver of claim 4, wherein the sustain driver circuit further comprises an energy recovery circuit which recovers energy discharged from the display panel by way of an LC resonant circuit and dispatches the recovered energy back to the display panel.

8. The driver of claim 4, wherein the sustain driver circuit is designed to have a capacitor clamp-type multi-level converting circuit structure.

9. The driver of claim 8, wherein the capacitor clamp-type multi-level converting circuit structure is designed by:

- connecting a plurality of capacitors in series;
- connecting one end of the series of the capacitors to ground and supplying a source voltage to the other end of the series of capacitors; and
- connecting switching elements to connection nodes of the capacitors,

wherein the structure enables zero voltage and +/- multi-level voltages that are systematic with respect to the zero voltage to be repeatedly supplied to the display panel during the sustain discharge period by changing current flow paths according to the predetermined switching sequences to drive the display panel.

10. The driver of claim 4, wherein the sustain driver circuit comprises:

- a block of energy accumulation elements in which first, second, third, and fourth capacitors are connected in series, a first end of the series is connected to a ground, and the other end of the series is connected to a source voltage of the sustain driver circuit;
- first and second inductors used to accumulate energy discharged from the X and Y axes electrodes of the display panel in combination with the block of energy accumulation elements;
- a first switching block connected between a connection node of the first and second capacitors and the second inductor to drive current to flow along an LC resonant circuit path via the second inductor during the charge/discharge mode for the X-axis electrode of the display panel;
- a second switching block connected between a connection node of the third and fourth capacitors and the first inductor to drive current to flow along an LC resonant circuit path via the first inductor during the charge/discharge mode for the Y-axis electrode of the display panel;

a third switching block to establish a current flow path to separately generate predetermined voltage waveforms that are required for the X and Y axes electrodes of the display panel according to the predetermined switching sequences to drive the display panel by connecting a first and a second switching element and a third and a fourth switching element in series, respectively, locating a first diode between the second and third switching elements, connecting a free end of the first switching element to ground, and connecting a free end of the fourth switching element to the source voltage for the sustain driver circuit, connecting a connection node of the first and second switching elements to the second inductor and the X-axis electrode of the display panel, connecting a connection node of the third and fourth switching elements to the first inductor, and connecting a connection node of the second and third capacitors to a connection node of the diode between the second and third switching elements and the third switching element; and

a capacitor is located between the connection node of the third and fourth switching elements and the isolation and reset circuit.

11. The driver of claim 10, wherein the first switching block comprises a plurality of switching elements and a plurality of diodes.

12. The driver of claim 10, wherein the second switching block comprises a plurality of switching elements and a plurality of diodes.

13. The driver of claim 4, wherein the isolation and reset circuit combination comprises:

an isolation circuit including a second diode and a fifth switching element connected between the sustain driver circuit and the scan pulse generation circuit, so as to isolate the scan pulse generation circuit from the energy recovery circuit included in the sustain driver circuit during the reset period, according to a predetermined reset switching sequence; and

a reset circuit used to separately generate reset voltage waveforms for the X and Y axes electrodes according to the predetermined switching sequences to drive the display panel by connecting a sixth switching element between a connection node of the scan pulse generation circuit and the isolation circuit, and the ground, connecting a third diode and a seventh switching element in series between the connection node of the scan pulse generation circuit and the isolation circuit and a first reset source voltage, and connecting an eighth switching element between the X-axis electrode and a second reset source voltage.

14. A method of designing a single-sided driver circuit to drive a display panel, the method comprising:

constructing the single-sided driver circuit including predetermined circuit elements having energy accumulation elements and switching elements,

wherein the circuit elements are arranged so as to establish current flow paths to generate predetermined driver voltage waveforms that are required for X and Y axes electrodes of the display panel according to predetermined switching sequences to drive the display panel.

15. The method of claim 14, wherein the circuit elements are arranged to supply zero voltage and +/- multi-level voltages that are symmetric with respect to the zero voltage to the display panel during a sustain discharge period, in the predetermined switching sequences to drive the display panel.

16. The method of claim 14, wherein a voltage to be supplied to the single-sided driver circuit is set to be twice as much as a voltage to be supplied to the display panel during a gas discharging mode in a sustain discharge period.

17. The method of claim 14, wherein the single-sided driver circuit is designed to have a capacitor clamp-type multi-level converting circuit structure.

18. The method of claim 17, wherein the capacitor clamp-type multi-level converting circuit structure is designed by:

connecting a plurality of capacitors in series;

connecting the series of the capacitors between ground and a source voltage to be supplied to a sustain driver circuit;

connecting each of connection nodes of the capacitors to each of switching elements;
and

repeatedly supplying zero voltage, and +/- multi-level voltages that are symmetric with respect to the zero voltage, to the display panel during a sustain discharge period, by changing current flow paths according to the predetermined switching sequences to drive the display panel.

19. A single-sided driver circuit to drive X and Y electrodes of a display panel, comprising:

an isolation and reset circuit combination to establish a current flow path to generate reset ramp voltage waveforms for the X and Y axes electrodes to eliminate wall charges on the display panel while cutting off the energy recovery path during a reset period;

a scan pulse generation circuit connected with the isolation and reset circuit combination and the X and Y axes electrodes to establish a current flow path to generate voltage waveforms for the X and Y axes electrodes to make wall charges on the display panel during an address period; and

a sustain driver circuit connected with the isolation and reset circuit combination and the X and Y axes electrodes to establish charging/discharging paths to charge/discharge the display panel according to predetermined switching sequences to drive the display panel during the sustain discharge period, and to establish predetermined current flow paths to generate a reset voltage waveform and an address discharge voltage waveform in combination with the reset circuit and the scan pulse generation circuit, respectively, during the reset period and the address period.

20. The single-sided driver circuit of claim 19, wherein the sustain driver circuit comprises:

first, second, third and fourth capacitors connected in series, one end of the series being connected to a ground and another end of the series being connected to a source voltage;

first, second, third and fourth switching elements connected in series, one end of the series being connected to the ground and another end being connected to the source voltage;

a first switching block and first inductor combination being connected at one end to a node connecting the first and second capacitors and at another end to a node connecting the first and second switching elements;

a second switching block and second inductor combination being connected at one end to a node connecting the third and fourth capacitors and at another end to a node connecting the third and fourth switching elements; and

a fifth capacitor connected at one end to the node connecting the third and fourth switching elements and the isolation and reset circuit combination.

21. The single-sided driver circuit of claim 19, wherein the isolation and reset circuit combination comprises:

an isolation circuit including a diode and a fifth switching element connected between the sustain driver circuit and the scan pulse generation circuit to isolate the scan pulse generation circuit during the reset period according to a predetermined reset switching sequence; and

a reset circuit to separately generate reset voltage waveforms for the X and Y axes electrodes according to the predetermined switching sequences to drive the display panel by connecting a sixth switching element between a connection node of the scan pulse generation circuit and the isolation circuit, and the ground, connecting a third diode and a seventh switching element in series between the connection node of the scan pulse generation circuit and the isolation circuit and a first reset source voltage, and connecting an eighth switching element between the X-axis electrode and a second reset source voltage.

22. A computer readable medium including data to perform a method of providing driving voltages required for X and Y axes electrodes of a display panel, the method comprising:

providing current flow paths to generate predetermined driving voltage waveforms required for both X and Y axes electrodes according to predetermined switching sequences to drive the display panel.

23. The computer readable medium of claim 22, further comprising data to perform the method of repeatedly supplying zero voltage and +/- multi-level voltages that are symmetric with respect to the zero voltage across the X and Y axes electrodes of the display panel during a sustain discharge period.